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I, LEANNE MYNOTT, MANAGER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2004900460 for a patent by DAVID MARK ALLISON as filed on 03 February 2004.

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Seventeenth day of January 2005

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Background of Invention

There are several methods of fixing bone pieces together; most commonly, these are fractured or severed pieces of bone, but not exclusively. Another set of circumstances where bone fragments are fixed together is in performing arthrodeses or joint fusions. In almost all cases of bone connections under consideration it is essential for the cut or fractured bone surfaces to be held together in close mutual confrontation. This intimacy of contact is usually referred to as compression. The need is for the bone surfaces to be held in well fitted contact and to be so held during bone healing or union. In practice the simplest way of ensuring this contact is, where practicable, to apply a compressive loading to the bone portions at a direction substantially normal to the severed bone faces.

Compressive loading, as described, can be achieved in several ways which will be outlined below.

The first method to consider is bone screws. There are two types: those with heads and those without heads. Those with heads apply the compressive force directly to the bony cortex (or surface) of one of the pieces of bone to be held together. Those without heads have threads at the leading and trailing edge separated by a shank devoid of thread. The threads of the leading and trailing ends have like handedness but different pitch so as to apply compressive force to the bone faces as the screw is tightened.

The next group of devices to consider are bone plates. These are in various configurations but most commonly longer in one dimension than the other, with a series of holes in a single row along the longest dimension. The long axis of the plates are applied normal (or as close to normal as practicable) to the surfaces which are to held together. They are held in place by bone screws with heads which are screwed into the bone through the holes in the plate. If the plate holes are elongated in the line of the long axis of the plate and screws are placed eccentrically away from the bone surface to be joined then on tightening of the screws there will be compression of the bone surfaces. Sometimes the screw is locked to the plate by having threads on the head of the screw which engage reciprocal threads in the plate.

Various types of staples are also used to fix severed bone pieces together. Some of these apply compression by virtue of their conformation. Some can be tightened in various ways so as to bring about compression of the bone surfaces.

These methods alluded to above are not always able to be used effectively. For example, it may not be possible to insert a screw in an appropriate direction in practice because of the anatomical location of the pieces of bone to be fixed. In a similar way it may not be possible to use a bone plate because of size constraints or reasons of surgical access. Staples are difficult to use in that they are often too large and can split the bone. The vertical elements can also pull out of the bone so that the fixation is not stable.

Because of these difficulties it is often necessary to use devices called Kirschner wires or pins. These are simple sharpened pins or thin rods that are drilled across the bone pieces. They cannot cause compression and sometime may even cause the bone fragments to be held apart leading to delay or absence of bone healing.

The object of this invention is to overcome or ameliorate the shortcomings of the devices alluded to above in a simple but effective manner. An embodiment of the invention consists of:

a) two annuluses or rings of suitable material, typically, but not confined, to metal
b) two bars or rods of appropriate length and thickness connecting the two annuluses together so that they are parallel to each other and in the same plane as the annuluses
c) the size and shape of each annulus is such that it accepts the head of a screw such as a bone screw.

An example of the invention is shown in the accompanying drawing. All drawings are of oversized scale.

Figure 1) is a plan elevation of the device.

Figure 2) is a side elevation of the device.

Figure 3) shows that by moving the connecting bars or rods (2) apart the annuluses (1) are drawn together. A similar situation would apply if the bars or rods were moved together.

Figure 4) shows one application of the invention so that if the device is place either side of two bone surfaces (3) to be fixed together and held in place by suitable screws (4) then by opening (or closing) the parallel elements (5) of the device the bone surfaces will be drawn together so that compression of the bone faces occurs. If the device was made of suitable material, once the bars or rods have been deformed as described, then the position will be maintained and the bone surfaces will remain compressed together.

In another embodiment of the invention, shown in figure 5, the annuluses would half the thickness of the bar sections. These would be of two types; those which are chamfered to accept the head of a screw (6) and those to accept the shaft (7). This allows two or more of the devices to be linked together, but be the same thickness as the bar sections, so that more than two pieces of bone may connected and held under compression. Suitable separate annular sections, or washers (8), can be utilised in those situations where three or more devices were not connected in an unbroken perimeter so as to maintain the overall thickness the same as that of the bar sections. Alternatively, one end of the device could be made the same thickness as the bar sections to obviate the need for a washer. This shows two devices connected together but three, four or more devices could be so connected if the number of bone pieces decreed that this was appropriate. It would also be possible have the angle between any two devices so

connected to be varied to suit different configurations of bone fragments as could the distance between the annuluses. This would make for a modular system and be useful in connecting multiple small bones of irregular size and shape such as in the carpal or small bones of the wrist but not limited to that situation.

The device is shown as having two annuluses or rings connected by two rods or bars but could also have more than two annuluses and the connecting rods or bars could be in other configurations than as shown and not necessarily be parallel.
The device therefore combines the advantages of both plates and staples. It has the compactness possible with staples but is solidly fixed to the bone by screws as are plates . Furthermore it is able to impart compression onto the bone faces keeping them in intimate contact. The device could be manufactured in a variety of sizes to suit different sizes of bone pieces.

Whilst described here for the fixation of bone pieces the use of the device is not confined to that purpose and could be utilised to fix together other material in situations not related to bone fixation.

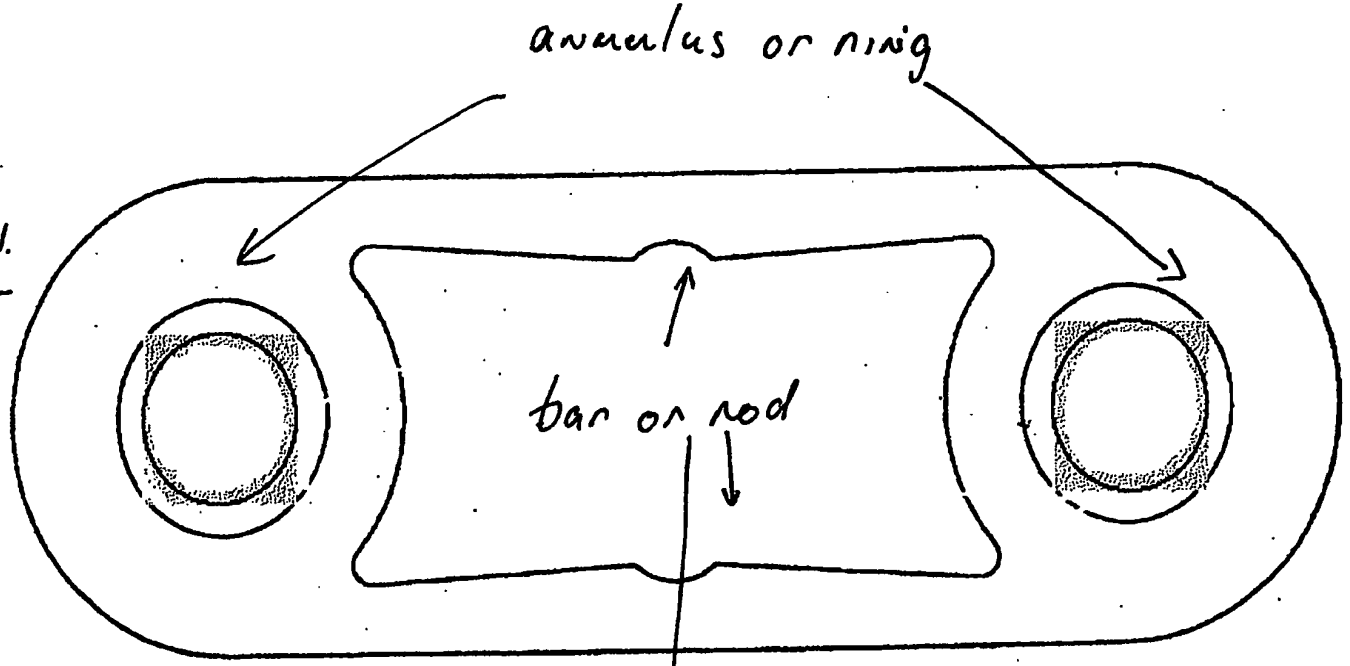

Figure 1.

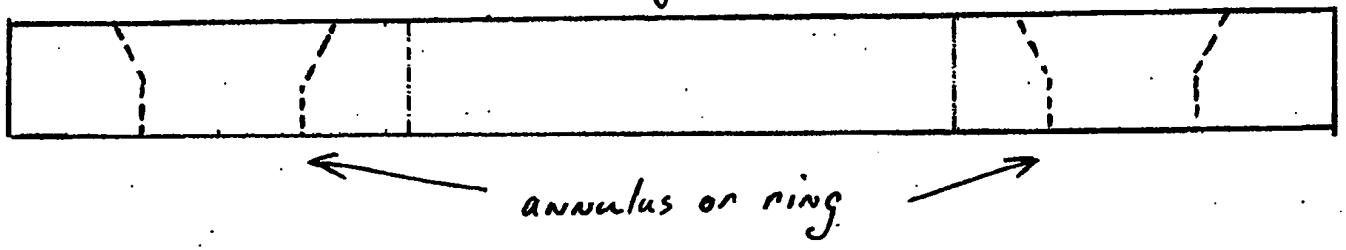

Figure 2.

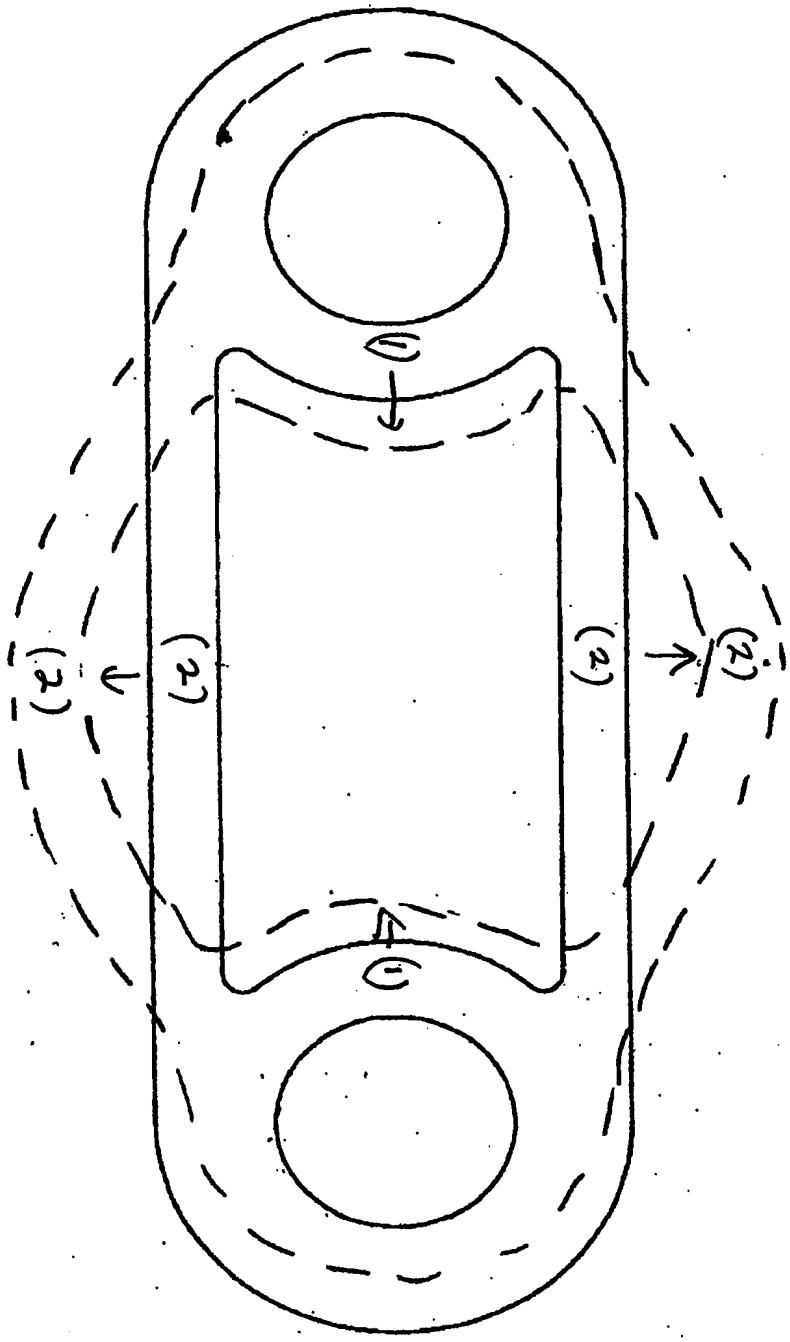

Figure 3

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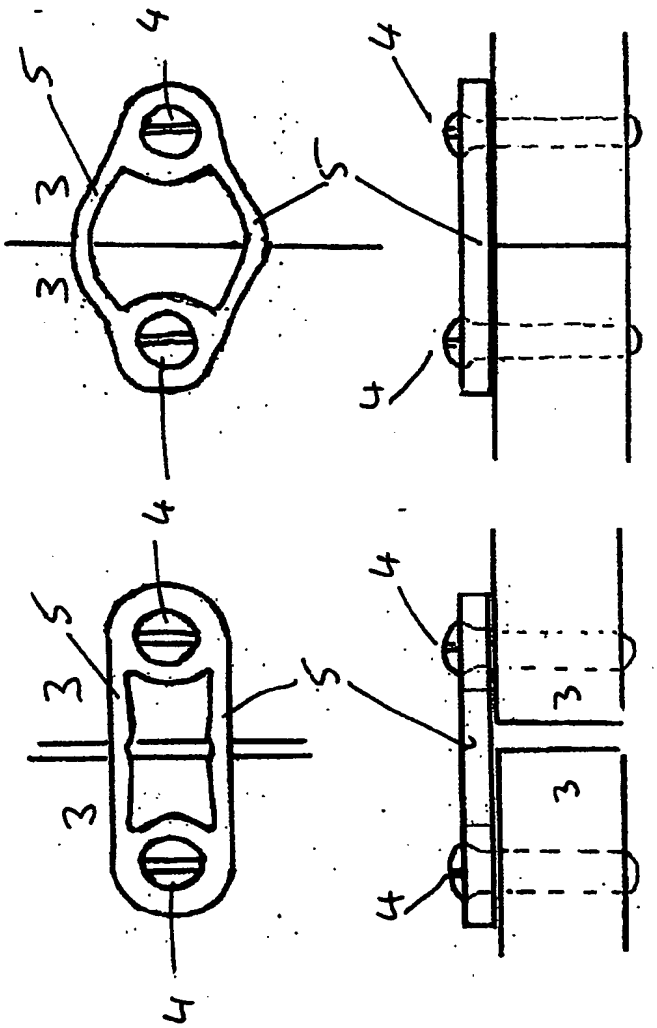
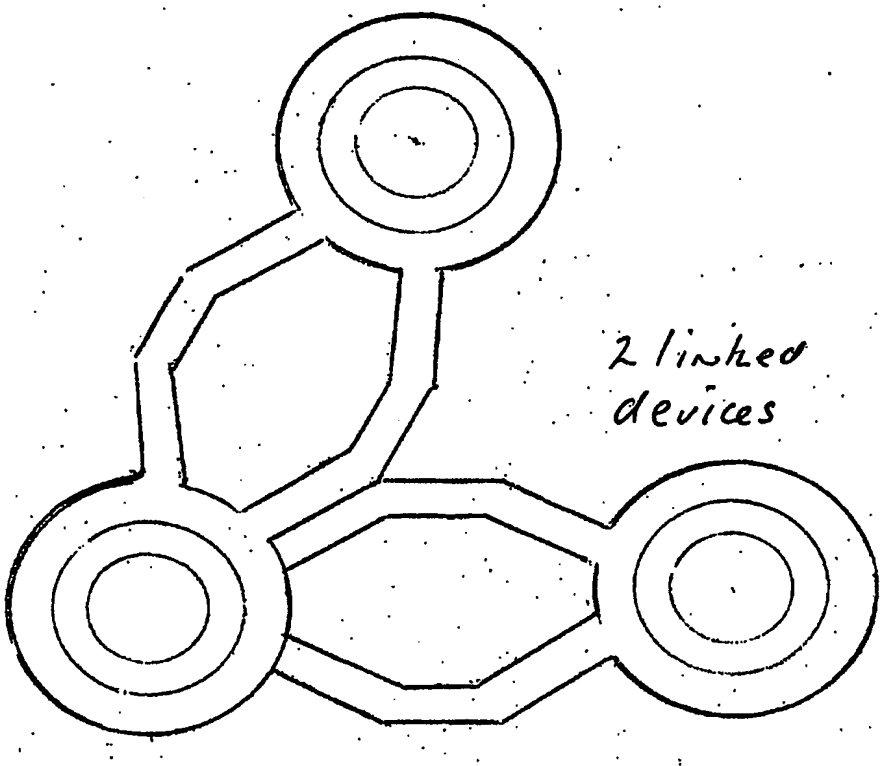


Figure 4.



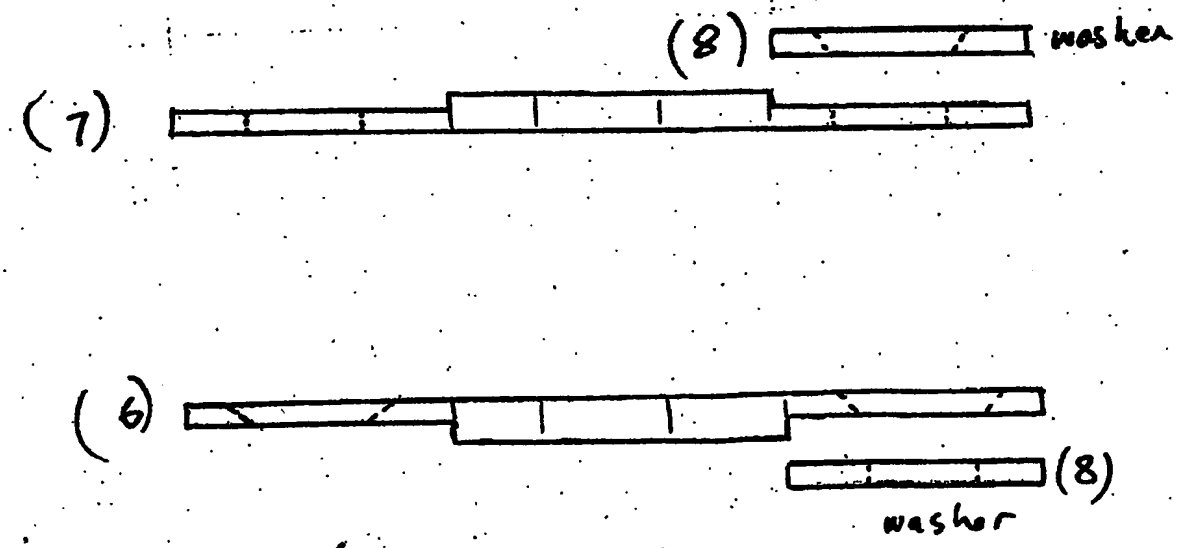


Figure 5.